

What is claimed is:

1. A flame retardant thermoplastic polyurethane composition comprising:
  - (a) at least one thermoplastic polyurethane polymer; and
  - (b) from about 28 to about 50 weight percent of melamine cyanurate as the sole organic flame retardant additive;wherein said thermoplastic polyurethane composition has an ultimate tensile strength greater than 1500 psi and a weight average molecular weight (Mw), as measured on said thermoplastic polyurethane polymer in a finished article, greater than 70,000 Daltons.
2. A thermoplastic polyurethane composition of claim 1 wherein said melamine cyanurate is present at a level of from about 34 to about 45 weight percent.
3. A thermoplastic polyurethane composition of claim 2 wherein said melamine cyanurate is present at a level of from about 35 to about 45 weight percent.
4. A thermoplastic polyurethane composition of claim 1 wherein said thermoplastic polyurethane composition has a molecular weight of from about 85,000 to about 180,000 Daltons.
5. A thermoplastic polyurethane composition of claim 4 wherein said thermoplastic polyurethane composition has a molecular weight of from about 100,000 to about 160,000 Daltons.
6. A thermoplastic polyurethane composition of claim 1 wherein said thermoplastic polyurethane polymer is selected from polyether polyurethane, polyester polyurethane, and polycarbonate polyurethane.
7. A thermoplastic polyurethane composition of claim 6 wherein said thermoplastic polyurethane polymer is a polyether polyurethane.

8. A thermoplastic polyurethane composition of claim 1 wherein said thermoplastic polyurethane polymer is a blend of at least one polyether polyurethane and at least one polyester polyurethane.

5 9. A thermoplastic polyurethane composition of claim 1 having an ultimate tensile strength greater than 2900 psi.

10 10. A thermoplastic polyurethane composition of claim 9 wherein said thermoplastic polyurethane composition has a molecular weight of from about 85,000 to about 180,000 Daltons and wherein said melamine cyanurate is present at a level of from about 35 to about 45 weight percent and wherein said thermoplastic polyurethane composition has an ultimate tensile strength greater than 3500 psi.

15 11. A thermoplastic polyurethane composition of claim 1 comprising up to 10 weight percent of inorganic flame retardants.

12. A process for producing a flame retarded thermoplastic polyurethane composition comprising mixing:

- 20 (a) at least one thermoplastic polyurethane polymer; and  
(b) from about 28 to about 50 weight percent of melamine cyanurate as the sole organic flame retardant additive;

25 wherein said thermoplastic polyurethane composition has an ultimate tensile strength greater than 1500 psi and a weight average molecular weight (Mw), as measured on said thermoplastic polyurethane polymer in a finished article, greater than 70,000 Daltons.

13. A process of claim 12 wherein said melamine cyanurate is present at a level of from about 34 to about 45 weight percent.

30 14. A process of claim 13 wherein said melamine cyanurate is present at a level of from about 35 to about 45 weight percent.

15. A process of claim 12 wherein said thermoplastic polyurethane composition has a molecular weight of from about 85,000 to about 180,000 Daltons.

5 16. A process of claim 15 wherein said thermoplastic polyurethane composition has a molecular weight of from about 100,000 to about 160,000 Daltons.

10 17. A process of claim 12 wherein said thermoplastic polyurethane polymer is selected from polyether polyurethane, polyester polyurethane, and polycarbonate polyurethane.

18. A process of claim 17 wherein said thermoplastic polyurethane polymer is a polyether polyurethane.

15 19. A process of claim 12 wherein said thermoplastic polyurethane polymer is a blend of at least one polyether polyurethane and at least one polyester polyurethane.

20. A process of claim 12 having an ultimate tensile strength greater than 2900 psi.

20 21. A process of claim 20 wherein said thermoplastic polyurethane composition has a molecular weight of from about 85,000 to about 180,000 Daltons and wherein said melamine cyanurate is present at a level of from about 35 to about 45 weight percent and wherein said thermoplastic polyurethane composition has an ultimate tensile strength greater than 3500 psi.

25 22. A process of claim 12 wherein said mixing is performed in a twin screw extruder having a feed end and a die end, said extruder having multiple heat zones and multiple feed ports between said feed end and said die end.

23. A process of claim 22 wherein said melamine cyanurate is added to said extruder in a heat zone which is closer to said die end than the heat zone where said thermoplastic polyurethane polymer is added to said extruder.

24. A process of claim 23 wherein said extruder has from 3 to 5 heat zones.

25. A process of claim 23 wherein said extruder heat zone nearest said feed end is heated to a higher temperature than said heat zones closer to said die end.

26. A process of claim 12 wherein said thermoplastic polyurethane composition is pelletized after mixing.

27. A flame retardant thermoplastic polyurethane composition comprising:

(a) at least one thermoplastic polyurethane polymer, said thermoplastic polyurethane polymer made by reacting at least one hydroxyl terminated intermediate with at least one isocyanate and at least one chain extender, wherein a cross linking agent having a functionality of greater than 2.0 is added at a level of from about 0.05 to about 2.0 mole percent based on the total moles of said chain extender; and

(b) at least one flame retardant additive capable of lowering the molecular weight of said thermoplastic polyurethane polymer during melt processing of said thermoplastic polyurethane composition.

28. A flame retardant thermoplastic polyurethane composition of claim 27 wherein the amount of said cross linking agent present is a level of from about 0.2 to about 1.0 mole percent based on the total moles of said chain extender present in said thermoplastic polyurethane composition.

29. A flame retardant thermoplastic polyurethane composition of claim 28 wherein said flame retardant additive is selected from melamine, melamine cyanurate, melamine borate, melamine phosphate, melamine derivatives, organic phosphates, organic phosphonates and mixtures thereof.

30. A flame retardant thermoplastic polyurethane composition of claim 29 wherein said thermoplastic polyurethane polymer is a polyether polyurethane polymer and said flame retardant is melamine cyanurate and said cross linking agent is trimethylol propane.

31. A wire and cable construction capable of passing both the requirements of UL-1581 section 1080 and UL-1581 section 1080 subject 758 section G tests comprising:

- (a) at least one metal conductor wherein said conductor is insulated with a non-conducting polymeric material; and
- (b) a flame retarded jacket covering said insulated metal conductor; wherein said jacket is a thermoplastic polyurethane composition comprising:
  - (i) at least one thermoplastic polyurethane polymer; and
  - (ii) from about 28 to about 50 weight percent of melamine cyanurate as the sole organic flame retardant additive and wherein said thermoplastic polyurethane composition has an ultimate tensile strength greater than 2900 psi and a weight average molecular weight (Mw), as measured on said thermoplastic polyurethane polymer in a finished article, greater than 100,000 Daltons.

32. A wire and cable construction of claim 31 wherein said melamine cyanurate is present at a level of from about 34 to about 45 weight percent.

33. A wire and cable construction of claim 32 wherein said melamine cyanurate is present at a level of from about 35 to about 45 weight percent.

34. A wire and cable construction of claim 31 wherein said thermoplastic polyurethane composition has a molecular weight of from about 100,000 to about 160,000 Daltons.

35. A wire and cable construction of claim 31 wherein said thermoplastic polyurethane polymer is selected from polyether polyurethane, polyester polyurethane and polycarbonate polyurethane.

5 36. A wire and cable construction of claim 31 wherein said thermoplastic polyurethane polymer is a polyether polyurethane.

37. A wire and cable construction of claim 31 wherein said thermoplastic polyurethane polymer is a blend of at least one polyether polyurethane and at least one polyester polyurethane.

38. A wire and cable construction of claim 31 wherein said thermoplastic polyurethane composition has an ultimate tensile strength greater than 3500 psi.

15 39. A wire and cable construction of claim 38 wherein said thermoplastic polyurethane polymer has a molecular weight of from about 100,000 to about 160,000 Daltons and wherein said melamine cyanurate is present at a level of from about 35 to about 45 weight percent.

20 40. A wire and cable construction of claim 31 wherein said construction has from 2 to 8 insulated metal conductors that are covered by said flame retarded jacket.

41. A wire and cable construction of claim 40 wherein said construction has from 3 to 5 insulated metal conductors that are covered by said flame retarded jacket.

25 42. A process for producing a wire and cable construction capable of passing both the requirements of UL-1581 section 1080 and UL-1581 section 1080 subject 758 section G tests comprising:

30 (a) extruding an insulation layer of a non-conducting polymeric material onto at least one metal conductor; and

(b) extruding a flame retardant jacket to cover said insulated metal conductor;  
wherein said jacket is a thermoplastic polyurethane composition comprising:

- (i) at least one thermoplastic polyurethane polymer; and
- (ii) from about 28 to about 50 weight percent of melamine cyanurate  
as the sole organic flame retardant additive and wherein said  
thermoplastic polyurethane composition has an ultimate tensile strength  
greater than 2900 psi and a weight average molecular weight (Mw), as  
measured on said thermoplastic polyurethane polymer in a finished  
article, greater than 100,000 Daltons.

43. A process of claim 42 wherein said melamine cyanurate is present at a level of  
from about 34 to about 45 weight percent.

44. A process of claim 43 wherein said melamine cyanurate is present at a level of  
from about 35 to about 45 weight percent.

45. A process of claim 42 wherein said thermoplastic polyurethane composition has a  
molecular weight of from about 100,000 to about 160,000 Daltons.

46. A process of claim 42 wherein said thermoplastic polyurethane polymer is  
selected from polyether polyurethane, polyester polyurethane, and polycarbonate  
polyurethane.

47. A process of claim 46 wherein said thermoplastic polyurethane polymer is a  
polyether polyurethane.

48. A process of claim 42 wherein said thermoplastic polyurethane polymer is a  
blend of at least one polyether polyurethane and at least one polyester polyurethane.

49. A process of claim 42 having an ultimate tensile strength greater than 3500 psi.

50. A process of claim 49 wherein said thermoplastic polyurethane polymer has a molecular weight of from about 100,000 to about 160,000 Daltons and wherein said melamine cyanurate is present at a level of from about 35 to about 45 weight percent.

5 51. A process of claim 42 wherein said wire and cable construction has from 2 to 8 insulated metal conductors that are covered by said flame retardant jacket.

10 52. A process of claim 51 wherein said metal conductors in said wire and cable construction are insulated by a layer of a polymeric material selected from polyvinyl chloride, polyethylene, cross-linked polyethylene, and fluorocarbon polymer and wherein said insulated metal conductors are covered by said flame retarded jacket.

15 53. A process of claim 42 wherein said thermoplastic polyurethane composition ingredients are mixed in a twin screw extruder having a feed end and a die end and said extruder having multiple heat zones and multiple feed ports between said feed end and said die end; wherein said melamine cyanurate is added to said extruder in a heat zone which is closer to said die end than the heat zone where said thermoplastic polyurethane polymer is added to said extruder; and wherein said thermoplastic polyurethane composition exiting said die end of said extruder is formed into said jacket for said wire and cable construction prior to cooling to ambient temperature and without first going through a pelletizing step.

20 54. A thermoplastic polyurethane composition having a LOI % less than about 25, as measured according to ASTM D2863, and a PRHR less than about  $310 \text{ kW/m}^2$ , as measured by a Cone Calorimeter according to ASTM E-1354 with a heat flux of  $35 \text{ kW/m}^2$ .

25 55. A thermoplastic polyurethane composition of claim 54 having a LOI % less than about 24 and a PRHR less than about  $295 \text{ kW/m}^2$ .